

WE CLAIM:

1. An apparatus for producing discontinuous lengths of filament, comprising:
- a rotatable first roll having a first severing structure;
 - a rotatable second roll having a second severing structure, the second severing structure corresponding with the first severing structure for severing a length of the filament positioned between the rolls;
 - a drive system operable to independently rotate the first roll and the second roll according to a drive command;
 - a sensor system operable to make measurements and generate current state signals representative of at least one actual current roll property of the first roll and at least one actual current roll property of the second roll; and
 - a control system for receiving the current state signals and operable to generate the drive command in accordance with predetermined control parameters and based on the at least one actual current roll property of the first roll and the at least one actual current roll property of the second roll, wherein the drive command synchronizes the at least one actual current roll properties of the first roll and the second roll.
2. The apparatus of claim 1, wherein the roll property is selected from rotational position and radial position.
3. The apparatus of claim 1, wherein the control system is operable to determine roll error signals corresponding to a difference between the actual current roll properties of the first roll and second roll and a desired roll property of the first roll and second roll, respectively, and wherein the control parameters utilize the roll error signals and the current state signals to calculate and determine the drive command.

4. The apparatus of claim 1, wherein the drive command comprises a first roll drive command and a second roll drive command, wherein the first roll drive command is based on the at least one actual current roll property of the first roll and the second roll drive command is based on the at least one actual current roll property of the second roll.

5. The apparatus of claim 1, wherein the drive command comprises a first roll drive command and a second roll drive command and both the first roll drive command and the second roll drive command are based on the at least one actual current roll property of the first roll.

6. The apparatus of claim 1, wherein the drive command comprises a first roll drive command and a second roll drive command, wherein the first roll drive command is based on the at least one actual current roll property of the first roll, at least one desired roll property of the first roll corresponding to the at least one actual current roll property of the first roll, and a system drive command based on a velocity of the filament between the first roll and the second roll, and wherein the second roll drive command is based on the at least one actual current roll property of the first roll, the at least one actual current roll property of the second roll, and at least one desired roll property of the second roll corresponding to the at least one actual current roll property of the second roll.

7. The apparatus of claim 6, wherein the at least one desired roll property of the first roll and the desired rotational position of the second roll correspond to the synchronized positioning of the first severing structure of the first roll and the second severing structure of the second roll.

8. The apparatus of claim 1, wherein the first severing structure comprises a plurality of slots spaced apart about a perimeter of the first roll, and the second severing structure comprises a plurality of elongated structures extending from and spaced apart about a perimeter of the second roll.

9. The apparatus of claim 8, wherein the plurality of slots extend longitudinally along the length of the first roll and the plurality of elongated structures

include a plurality of cutting blades extending longitudinally along the length of the second roll.

10. The apparatus of claim 1, wherein the drive system is further operable to position the first roll and the second roll at a desired radial spacing with respect to each other.

11. The apparatus of claim 10, wherein the sensor system is further operable to measure and generate a current radial position signal that represents a current radial spacing between the first roll and the second roll, and wherein the control system is further operable for receiving the current radial position signal and for generating a drive command based on a radial spacing error signal corresponding to a difference between the current radial spacing and a desired radial spacing.

12. An apparatus for producing discontinuous lengths of filament, comprising:

a rotatable first roll having a first severing structure;

a rotatable second roll having a second severing structure, the second severing structure corresponding with the first severing structure for severing a length of filaments positioned between the rolls;

a drive system operable to independently rotate the first roll and the second roll according to a first roll drive command and a second roll drive command, respectively;

a sensor system operable to receive rotational positional inputs representative of an actual current rotational position of the first roll and an current rotational position of the second roll, the sensor system further operative to generate a first roll current position state signal and a second roll current position state signal corresponding to the rotational positional inputs;

a control system operable to receive the first roll current position state signal and the second roll position state signal and generate the first roll drive command and the second roll drive command, respectively, in accordance with a predetermined set of control parameters and as determined by the first roll current position state signal and the second roll current position state signal, wherein the control system determines the first roll drive command

and the second roll drive command so that the respective positioning of the corresponding severing structures is synchronized during rotation of the first roll and the second roll.

5 13. The apparatus of claim 12, wherein the control system is operable to determine a first roll error signal corresponding to a difference between the actual current rotational position of the first roll and a desired rotational position of the first roll, wherein the control parameters utilize the first roll error signal and the first roll current state signal to determine the first roll drive command, and a second roll error
10 signal corresponding to a difference between the actual current rotational position of the second roll and a desired rotational position of the second roll, and wherein the control parameters utilize the second roll error signal and the second roll current state signal to determine the second roll drive command.

15 14. The apparatus of claim 12, wherein the sensor system is further operable to measure and generate a current position signal that represents an actual current radial spacing between the first roll and the second roll, and wherein the control system is further operable for receiving the current position signal and for
20 generating a drive command based on a radial spacing error signal corresponding to a difference between the actual current radial spacing and a desired radial spacing.

15. An apparatus for producing discontinuous lengths of filament, comprising:

- 25 a rotatable first roll having a first severing structure;
- a rotatable second roll having a second severing structure, the second severing structure corresponding with the first severing structure for severing a length of the filament positioned between the rolls;
- a drive system operable to independently rotate and radially position the first roll and the second roll according to a first roll drive command, a second roll drive
30 command, and a roll spacing drive command;
- a sensor system operable to receive positional inputs representative of an actual current rotational position of the first roll, an actual current rotational position of the second roll, and an actual current radial spacing between the first roll and the second roll, the sensor system further operative to generate a first roll current

rotational position state signal, a second roll current rotational position state signal, and a current radial spacing state signal corresponding to the positional inputs; and

a control system operable to receive the first roll current rotational position state signal, the second roll current rotational position state signal, and the current radial spacing state signal and generate the first roll drive command, the second roll drive command, and the spacing drive command, wherein the control system synchronizes the positioning of the first severing structure and second severing structure during rotation of the first roll and the second roll.

16. A method for producing discontinuous lengths of filament, comprising: receiving current state signals representative of an actual current roll property of a first roll having a first severing structure and an actual current roll property of a second roll having a second severing structure, wherein the first roll and the second roll are independently rotatable, and the second severing structure corresponds with the first severing structure; and

generating a drive command based on predetermined control parameters and the current state signals, wherein the drive command rotationally synchronizes the actual current roll property of the first roll with the actual current roll property of the second roll for severing a length of the filament positioned between the rolls.

17. The method of claim 16, further comprising generating desired roll property signals representative of a desired roll property of the first roll and a desired roll property of the second roll, and wherein the driving command is further based on the desired roll property signals.

18. The method of claim 16, wherein the drive command comprises a first roll drive command and a second roll drive command, further comprising:

receiving a system drive command associated with a velocity of the filament between the first roll and the second roll;

generating the first roll drive command based on the actual current roll property of the first roll, a desired roll property of the first roll, and a system drive command; and

generating the second roll drive command based on the actual current roll property of the first roll, the actual current roll property of the second roll, and a desired roll property of the second roll.

19. A method for producing discontinuous lengths of filament, comprising:
rotating a first roll having a first severing structure;
rotating a second roll having a second severing structure;
5 monitoring actual current rotational position of the first roll;
generating a first roll current rotational position signal representative
of the actual current rotational position of the first roll;
monitoring actual current rotational position of the second roll;
generating a second roll current rotational position signal
10 representative of the actual current rotational position of the second roll;
generating a first roll drive command in accordance with
predetermined control parameters and based on the actual current rotational
position of the first roll and a desired rotational position of the first roll; and
generating a second roll drive command in accordance with
15 predetermined control parameters and based on the actual current rotational
position of the second roll and a desired rotational position of the second roll,
wherein the first drive command and second drive command synchronizes
the first severing structure of the first roll and the second severing structure
second roll for severing a length of the filament positioned between the first
20 and second rolls.

20. The method of claim 19, further comprising monitoring actual current
radial spacing between the first roll and the second roll, generating a current radial
spacing signal representative of the actual current radial spacing between the first
25 roll and the second roll, generating a radial spacing drive command in accordance
with predetermined control parameters and based on the actual current radial
spacing and a desired radial spacing between the first roll and the second roll.